PCT/EP2004/051725

EP04/51725

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Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

1. Your reference — RLP52872GB

2. Patent application number *(The Patent Office will fill in this part)* — 0321425.1 — 12 SEP 2003

3. Full name, address and postcode of the or of each applicant *(underline all surnames)* — Telefonaktiebolaget LM Ericsson (Publ)
SE-12625
Stockholm
Sweden

Patents ADP number *(if you know it)* — 06974400 1

If the applicant is a corporate body, give the country/state of its incorporation — Sweden

4. Title of the invention — Radio Resource Usage Optimisation in a Packet Network

5. Name of your agent *(if you have one)* — Marks & Clerk

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)* —
4220 Nash Court
Oxford Business Park South
Oxford OX4 2RU
United Kingdom

Patents ADP number *(if you know it)* — 7271125001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*
a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d)) — Yes

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Continuation sheets of this form	
Description	5
Claim(s)	1
Abstract	1
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Priority documents	
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Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature Marks & Clerk Date 12 September 2003

Marks & Clerk

12. Name and daytime telephone number of person to contact in the United Kingdom

Dr. Robert Lind
01865-397900

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Notes

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Radio Resource Usage Optimisation in a Packet Network

This invention relates to a method for optimising radio resource usage in a packet network and in particular to optimising the radio link layer performance for the so called "Push-To-Watch" service to be offered by mobile wireless network operators. The Push-To-Watch service involves exchanging pictures on a packet switched (PS) connection between users whilst a circuit switched (CS) voice call is active.

According to a first aspect of the present invention there is provided a method of optimising the use of radio resources in a mobile radio communication system during a combinational multimedia session involving circuit switched and packet switched sessions between user terminals, the method comprising:

disabling an in-sequence delivery option of packets between radio network control nodes of the radio access network(s) serving the user terminals for said packet switched session.

In a first embodiment of the invention, said packets are Service Data Units, assembled at the sending side radio network controller from Protocol Data Units.

In a second embodiment of the invention, said packets are Protocol Data Units. These units are assembled at the receiving side Terminal into Service Data Units.

According to a second aspect of the present invention there is provided a method of optimising the use of radio resources in a mobile radio communication system during a combinational multimedia session involving circuit switched and packet switched sessions between user terminals, the method comprising:

setting one or more TCP sending parameters at at least one user terminal for said packet switched session so as to optimise radio resource

usage, the TCP parameter(s) being different from the parameter(s) used for non-combinational multimedia session related packet traffic.

Said TCP value may be segment size or initial window size.

Example 1

Figure 1 illustrates schematically the Radio Link configuration for the Push-To-Watch service. The transport chain of the Push-To-Watch service consists of two cascaded radio links as shown in Figure 1. In the state of the art solution, these links are totally decoupled, meaning that retransmissions and window control is done separately without coordination. Assuming both radio link protocols perform selective repeat ARQ with in-sequence delivery (as used in most cellular systems), this may lead to a situation where the buffers of the Radio Link B drain because Radio Link A is performing retransmissions.

Consider the following example. Radio Link A is performing a retransmission of a Protocol Data Unit (PDU) number 3 from Terminal A to UTRAN A (that is the RNC of UTRAN A). Because of the selective repeat function, UTRAN A continues to receive PDU numbers 4 and 5, but because of the in-sequence delivery function, it is unable to forward any packets to UTRAN B (that is the RNC of UTRAN B) until the missing PDU number 3 is received correctly. This behavior is well known and will produce a certain jitter in the outgoing data flow of Radio Link A. Because of the selective repeat function of the radio link protocol, the radio link utilization in UTRAN A will however remain good as long as the window is open. The problem occurs in Radio Link B, where the jitter in the incoming data flow from UTRAN A may cause the buffer at UTRAN B to drain, causing radio link under utilization, which in turn prolongs the picture transfer time.

The in-sequence delivery option may be inhibited by specifying this in the request sent by the core network (e.g. the SGSN) to establish the PS bearer for

the Push-To-Watch service. The IMS may notify the SGSN of the nature of the bearer.

The solution proposed here is to disable the in-sequence delivery option of the first radio link, (i.e. from Terminal A to the RNC of UTRAN A) for the Push-To-Watch service, upon detection that the Push-To-Watch service has been activated. In a first version this can be done at the Service Data Unit (SDU) level, so that Radio Link A is able to forward an SDU as soon as all of the SDU components have been received. The RLC layer at the RNC already includes the option to disable of the in-sequence delivery. No changes to the relevant RLC protocol will therefore be required to implement this solution.

In a modified embodiment, the reassembly function of Radio Link A is disabled so that Radio Link A forwards PDUs (i.e. the sub-components of the SDUs) to Radio Link B as soon as they have been correctly received. Radio Link B will then use the same PDUs and sequence numbers as in Radio Link A, reassembling the PDUs into SDUs as they are correctly received in Terminal B. This requires a tunnelling of the Radio Link PDUs from Radio Link A to Radio Link B. This approach offers increased granularity in the transmission path, offering the possibility of better use of the radio links. However the price is that the RLC protocol must be changed.

Embodiments of the invention improve radio link utilization, and therefore picture transfer times are reduced for the Push-To-Watch service.

Example 2

This embodiment proposes optimisation of the transport layer for the Push-To-Watch service, in which a picture is transmitted between the two parties of an ongoing voice call.

In the state of the art solution, pictures are transmitted from a user Terminal A to a user Terminal B using an end-to-end TCP connection as already described

with reference to Figure 1. A problem with this solution is the increased round trip time (RTT) caused by the cascaded radio links (A and B). Long RTTs directly affect the performance of the TCP slow start mechanism at a sending terminal, where TCP is opening up the sender's transmission window. The rate at which the window is opened depends on the ACKs received at the sender from the receiver. If the ACKs are delayed, the slow start period is prolonged. During slow start, TCP is not able to fully utilize the link, which means that picture transfer times increase. The pictures transmitted will be small in size 3 – 50 kBytes, which means that TCP will mostly be in the slow start phase for the period that it takes to send a picture.

The proposal is to either use a proprietary protocol for the picture transmissions or to use modified TCP parameters, the protocol modifying the TCP parameters at the TCP sender in dependence upon the service to which the data to be sent relates. For example, when the sender wishes to send picture data associated with Push-To-Watch, the TCP parameters are altered from their "normal" values. TCP parameters to modify are the segment size and initial window. These will affect the slow start performance and are usually used to ensure a fair share of resources between users in the Internet. Because of the closed nature of the transmission chain, a diversion from the normal recommendations is acceptable. The transmission rate of Radio Link A will limit the rate of traffic entering the core network.

The maximum segment size (MSS) shall be set to 1460 bytes. The second radio link will be idle until the first segment has traversed Radio Link A, and a larger size will only prolong this time, and therefore also the total picture transfer time. The initial window shall be set as large as possible, still making sure RLC buffers do not overflow or drop packets in Terminal A. Ideally, the initial window is set larger than or equal to the picture being transmitted. This means that Radio Link A has full utilization immediately and the picture transfer time is then not limited by the transport layer.

This embodiment of the invention helps reduce picture transmission times for the Push-To-Watch service.

CLAIMS:

1. A method of optimising the use of radio resources in a mobile radio communication system during a combinational multimedia session involving circuit switched and packet switched sessions between user terminals, the method comprising:

disabling an in-sequence delivery option of packets between radio network control nodes of the radio access network(s) serving the user terminals for said packet switched session.

2. A method of optimising the use of radio resources in a mobile radio communication system during a combinational multimedia session involving circuit switched and packet switched sessions between user terminals, the method comprising:

setting one or more TCP sending parameters at at least one user terminal for said packet switched session so as to optimise radio resource usage, the TCP parameter(s) being different from the parameter(s) used for non-combinational multimedia session related packet traffic.

ABSTRACT

Radio Resource Usage Optimisation in a Packet Network

A method of optimising the use of radio resources in a mobile radio communication system during a combinational multimedia session involving circuit switched and packet switched sessions between user terminals, the method comprising:

disabling an in-sequence delivery option of packets between radio network control nodes of the radio access network(s) serving the user terminals for said packet switched session.

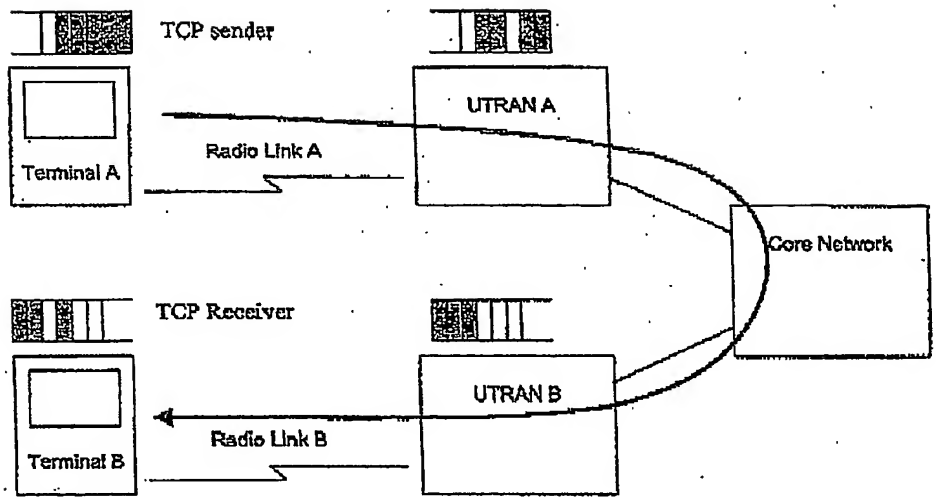
TCP sender
UTRAN A
Terminal A
Radio Link A
Core Network
TCP Receiver
UTRAN B
Terminal B
Radio Link B

Figure 1